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(71)Applicant : MITSUBISHI PLASTICS IND LTD

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(72)Inventor : TAKAGI JUN

(54) LACTIC ACID RESIN ARTICLES AND ITS RECYCLING PROCESS

(57)Abstract:

PROBLEM TO BE SOLVED: To provide lactic acid resin articles which have good physical properties and recycling properties used for automobile parts, electric appliance parts and their shredder dust, and also to provide an economical recycling process for these articles.

SOLUTION: Automobile parts and electric appliance parts contain a lactic acid resin composition as a major component and shredder dust comes from automobile parts and electric appliance parts containing a lactic acid resin composition. The lactic acid resin composition comprises: (1) 30-100% of a lactic acid resin, (2) 0-50 wt.% of an aliphatic polyester having Tg of $\leq 0^{\circ}\text{C}$ and/or an aromatic aliphatic polyester, (3) 0-50 wt.% of an inorganic filler, (4) 0-10 wt.% of a hydrolysis preventing agent and (5) 0-50 wt.% of a plasticizer.

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CLAIMS

[Claim(s)]

[Claim 1] The autoparts or the household-electric-appliances components which contain a lactic-acid system resin constituent as a principal component.

[Claim 2] Shredder dust originating in the autoparts or the household-electric-appliances components which contain a lactic-acid system resin constituent as a principal component.

[Claim 3] The autoparts according to claim 1 or 2 to which said lactic-acid system resin constituent is characterized by 30 - 100% of 1 lactic-acid system resin and 2Tg consisting of aliphatic series polyester 0 degree C or less and/or 0 - 50 % of the weight of aromatic series aliphatic series polyester, 0 - 50 % of the weight of 3 inorganic fillers, 0 - 10 % of the weight of 4 hydrolysis inhibitors, and 0 - 50 % of the weight of five plasticizers, household-electric-appliances components, or shredder dust.

[Claim 4] The autoparts, household-electric-appliances components, or shredder dust of claim 1-3 to which said autoparts and household-electric-appliances components are characterized by being a rigid object, an elastic body, a fiber structure object, or foam given in any 1 term.

[Claim 5] The autoparts, household-electric-appliances components, or shredder dust of claim 1-4 characterized by fabricating said autoparts or household-electric-appliances components by injection molding, extrusion molding, press forming, blow molding, or the SMC method given in any 1 term.

[Claim 6] The autoparts, household-electric-appliances components, or shredder dust of claim 1-5 to which said autoparts or household-electric-appliances components are characterized by being compounded with the natural fiber given in any 1 term.

[Claim 7] The autoparts, household-electric-appliances components, or shredder dust of claim 1-6 characterized by the relative degree of crystallinity of the lactic-acid system resin contained in said lactic-acid system resin constituent being 30 - 100% given in any 1 term.

[Claim 8] The autoparts, household-electric-appliances components, or shredder dust of claim 3-7 characterized by being at least one kind chosen from the group which said hydrolysis inhibitor becomes from a hydrophobic wax, a hydrophobic plasticizer, olefin system resin, and a carbodiimide compound given in any 1 term.

[Claim 9] The autoparts, household-electric-appliances components, or shredder dust of claim 1-8 characterized by for the lactic-acid system resin contained in said lactic-acid system resin constituent serving as Pori L-lactic acid from the mixture of a Pori D-lactic acid substantially, and forming stereo complex substantially given in any 1 term.

[Claim 10] The autoparts, household-electric-appliances components, or shredder dust of claim 3-9 characterized by for said inorganic filler being stratified silicic acid, and forming the nano composite after shaping given in any 1 term.

[Claim 11] The recycle approach of heating shredder dust according to claim 2 to 10 at 150-280 degrees C, and collecting steamy components.

[Claim 12] The recycle approach according to claim 11 characterized by the constituent which consists of a lactic-acid system resin constituent at the time of recycle containing 0.1 - 1.0% of the weight of moisture.

[Claim 13] The recycle approach according to claim 11 or 12 characterized by for said steamy component being a lactide, carrying out the polymerization of the collected lactide again, and considering as lactic-acid system resin.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the recycle approach of those products at products, such as shredder dust of autoparts excellent in recycle nature, household-electric-appliances components, and autoparts and household-electric-appliances components, and a list.

[0002]

[Description of the Prior Art] In our country, the about 5 million-set "used automobile" per year is generated in recent years. Among these, 4 million-4,500,000 except a part for used car export are a car for dismantling recycle. Although the so-called illegal abandonment car is presumed in this to be less than 1 % of the weight, by processing of an abandonment vehicle processing cooperation meeting on the street etc., finally, 99% of the weight or more of used automobiles are recalled, and it is also processed. The flow of the recycle is as follows.

[0003] The recalled used vehicle removes components in the "dismantling industry", and while supplying the commercial scene as used parts, after carrying out proper processing, for example, after it removes the dangerous substance, such as liquid, dc-batteries, etc., such as a gasoline and oil, it serves as a body scrap. The body scrap is circulating as a metal raw material, while glass, a sheet, etc. had been included, and it is recycled in the "shredder industry" of a back process. In the shredder industry, the body scrap was crushed by the shredder machine, glass waste and waste plastics were classified as shredder dust, and it reclaimed land from them, and they are disposed of at the same time a mechanical sorting machine and a help "sort out" and it collects metals. Such a recycle system has spread since 1970 and 75 - 80% of the weight of the amount of automatic car weight is recycled in current.

[0004] However, in recent years, in the shredder industry, it reclaims land with a drop of an iron scrap price, economical efficiency gets worse quickly by the continuous rise of a disposal cost, and a body scrap is changing to the treatment as "industrial waste" from the treatment as conventional "valuables." The new reclaimed ground of a disposal field is very difficult for causing a citizens' suit problem in various places etc., and especially the reclamation disposal cost of shredder dust is in the situation of not falling even if it may go up.

[0005] Shredder dust reclaimed land from glass waste or waste plastics as trash which does not contain harmful matter fundamentally to the simple "stabilization mold reclamation disposal field" without a water treatment function, and has so far been disposed of. However, the unjust abandonment incident of the industrial waste containing shredder dust arises, and the prospect of the solution does not stand yet. The survey by the Ministry of Health and Welfare and the Environment Agency to shredder dust starts after that, there will be amendment of Wastes Disposal and Public Cleaning Law in strengthening of the environmental standards in connection with water pollution, and 94 in 93, and it was decided to shift to "management mold reclamation disposal" in which shredder dust had the conventional stabilization mold reclamation disposal to a waterproof function, and a waste-water-treatment function from April, 96. However, compared with a stabilization mold, the management mold of a reclamation disposal cost will be more expensive, and it will soar further.

[0006] The motion of the government involving automobile recycle and the industrial world is progressing synchronizing globally. In our country, as automobile recycle by the independent measure of the related business circles instead of a regulation system, the "recycle initiative" was summarized by the Ministry of International Trade and Industry, and was released in 1997. It reclaimed land from the domestic rate-of-recycling target in 85 % of the weight or more and 2015 in 2002, it reclaimed land from it as a still more nearly unique target to Japan 95% of the weight or more in the 3/5 or less amount of shredder dust reclamation disposal, and 2015 in 2002, and has the 1/5 or less amount of disposal. Current and an automobile are recycled 75 to 80% of the weight through a dismantling phase, a shredder phase, and each phase of shredder dust judgment processing, and the 20 - 25 remaining % of the weight reclaims land from them as shredder dust, and they are disposed of. From the above situations, the technical problem concerning the disposal of an automobile is construction of the new recycle root replaced with reclamation disposal of this shredder dust, and, for that purpose, development of new recycling technology including a thermal recycling technique is needed. Although development of a thermal recycling technique has progressed as it is, it also has a dioxin generating problem accompanying combustion, and the problem of processing of a combustion residue, and cannot be said to be perfect recycling technology. Moreover, although examination of oil-izing is also carried out, it is not practical on the problem of purity etc.

[0007] On the other hand, although the Home Appliances Recycling Law will be enforced from 2001 and the rate of recycling of components etc. is rising also in recycle of household electric appliances, finally the case except useful components, such as substrates and a motor, etc. is often especially shredder-dust-ized with the automobile body scrap in large-sized household electric appliances. Therefore, also in recycle of household electric appliances, the same technical problem as the above-mentioned automobile recycle is held.

[0008] Incidentally, it serves as fiber resin and 15% of the weight, and 49% of the weight of shredder dust serves as rubber 7% of the weight, 2/3 of the whole are polymers, i.e., the resin of a wide sense, and, in other words, the problem of shredder dust is exactly a problem of "processing of a metal glass, etc. and the intermingled resin." In order to solve automobile trash and a household-electric-appliances trash problem and to promote recycle as a target, components and shredder dust excellent in recycle nature needed to be developed, and the economical recycle approach needed to be established.

[0009]

[Problem(s) to be Solved by the Invention] That is, the technical problem of this invention is to provide products, such as autoparts excellent in physical properties and recycle nature, a household-electric-appliances component, and its shredder dust, and a list with the recycle approach of these products excellent in economical efficiency.

[0010]

[Means for Solving the Problem] this invention persons came to complete this invention, as a result of repeating examination wholeheartedly in view of such the present condition. Invention concerning this application is attained by the following (1) - (13).

- (1) The autoparts or the household-electric-appliances components which contain a lactic-acid system resin constituent as a principal component.
- (2) Autoparts which contain a lactic-acid system resin constituent as a principal component, or shredder dust of the household-electric-appliances components origin.
- (3) As for the above-mentioned lactic-acid system resin constituent, 30 - 100% of 1 lactic-acid system resin and 2Tg can consist of aliphatic series polyester 0 degree C or less and/or 0 - 50 % of the weight of aromatic series aliphatic series polyester, 0 - 50 % of the weight of 3 inorganic fillers, 0 - 10 % of the weight of 4 hydrolysis inhibitors, and 0 - 50 % of the weight of five plasticizers.
- (4) The above-mentioned autoparts or household-electric-appliances components can be a rigid object, an elastic body, a fiber structure object, or foam.
- (5) The above-mentioned autoparts can be fabricated by injection molding, extrusion molding, press forming, blow molding, or the SMC method.
- (6) The above-mentioned autoparts or household-electric-appliances components may be compounded

with the natural fiber.

(7) The relative degree of crystallinity of the lactic-acid system resinous principle contained in the above-mentioned lactic-acid system resin constituent can be 30 - 100%.

(8) The above-mentioned hydrolysis inhibitor can be at least one kind chosen from the group which consists of a sheet silicate, a hydrophobic wax, a hydrophobic plasticizer, olefin system resin, and a carbodiimide compound.

(9) Substantially, the lactic-acid system resin contained in the above-mentioned lactic-acid system resin constituent can serve as Pori L-lactic acid from a mixture with a Pori D-lactic acid substantially, and can form stereo complex.

(10) The above-mentioned inorganic filler is stratified silicic acid, and can form the nano composite after shaping.

(11) The recycle approach of heating the above-mentioned shredder dust at 150-280 degrees C, and collecting steamy components.

(12) The recycle approach characterized by the constituent which consists of a lactic-acid system resin constituent at the time of the above-mentioned recycle containing 0.1 - 1.0% of the weight of moisture.

(13) It is a lactide, and the above-mentioned steamy component can carry out the polymerization of the collected lactide again, and can consider as lactic-acid system resin.

[0011]

[Embodiment of the Invention] This invention is explained to a detail below. The lactic-acid system resin in this invention may mean Pori DL[the Pori L-lactic acid whose structural unit is L-lactic acid, the Pori D-lactic acid whose structural unit is D-lactic acid, and whose structural unit are L-lactic acid and D-lactic acid]-lactic acids, and these mixtures, and may be a copolymer with alpha-hydroxycarboxylic acid, or diol/dicarboxylic acid further. However, it is important that DL configuration of lactic-acid system resin is L body:D object =100:0-90:10 or L body:D object =0:100-10:90. If out of range, the thermal resistance of components is hard to be obtained and there is this thing [that an application is restricted].

[0012] As a polymerization method of lactic-acid system resin, any well-known approaches, such as a condensation polymerization method and a ring-opening-polymerization method, are employable. for example, a condensation polymerization method -- if -- the lactic-acid system resin which carried out direct dehydration condensation polymerization of L-lactic acid, D-lactic acids, or such mixture, and had the presentation of arbitration can be obtained.

[0013] By the ring-opening-polymerization method, a polylactic acid system polymer can be obtained using the catalyst chosen in the lactide which is the annular dimer of a lactic acid while using the modifier etc. if needed. There are L-lactide which is the dimer of L-lactic acid, D-lactide which is the dimer of D-lactic acid, and a DL-lactide which consists of L-lactic acid and a D-lactic acid further as lactide, and lactic-acid system resin with the presentation of arbitration and crystallinity can be obtained by mixing and carrying out the polymerization of these if needed.

[0014] Furthermore, non-aliphatic series diol like non-aliphatic series dicarboxylic acid like a terephthalic acid and/or the ethyleneoxide addition product of bisphenol A as a little copolymerization component may be used if needed for raising thermal resistance etc. A small amount of chain elongation agent, for example, a diisocyanate compound, an epoxy compound, an acid anhydride, etc. may be used for the purpose of molecular-weight increase further again.

[0015] As other hydroxycarboxylic acid units by which copolymerization is carried out to lactic-acid system resin The optical isomer of a lactic acid (to L-lactic acid, it is L-lactic acid to D-lactic acid and D-lactic acid), A glycolic acid, 3-hydroxybutyric acid, 4-hydroxybutyrate, 2-hydroxy n-butyric acid, 2-hydroxy - Lactone, such as 2 organic-functions aliphatic series hydroxycarboxylic acid and caprolactones, such as 3 and 3-dimethyl butanoic acid, 2-hydroxy-3-methyl butanoic acid, 2-methyl lactic acid, and a 2-hydroxy caproic acid, a butyrolactone, and a valerolactone, is mentioned.

[0016] As the above-mentioned aliphatic series diol by which copolymerization is carried out to lactic-acid system resin, ethylene glycol, 1,4-butanediol, 1, and 4-cyclohexane dimethanol etc. is mentioned. Moreover, as the above-mentioned aliphatic series dicarboxylic acid, a succinic acid, an adipic acid, a

suberic acid, a sebacic acid, dodecane diacid, etc. are mentioned.

[0017] The most desirable thing as copolymerization is block copolymerization. It can consider as the polymer possessing transparency and shock resistance by making a polylactic acid segment into an ABA block copolymer typically, if A, for example, a diol dicarboxylic acid segment, is set to B. In this case, as for the glass transition temperature (Tg) of the segment of B, it is desirable that it is 0 degree C or less, when discovering shock resistance.

[0018] As range where the weight average molecular weight of lactic-acid system resin is desirable, it is 100,000 to 250,000 preferably to 50,000 to 400,000, and a pan. When less than this range, practical use physical properties are hardly discovered, but in exceeding, melt viscosity is too high and inferior to fabrication nature.

[0019] In this invention, it is desirable for 30 - 100% of 1 lactic-acid system resin and 2Tg to consider as the lactic-acid system resin constituent of aliphatic series polyester 0 degree C or less and/or 0 - 50 % of the weight of aromatic series aliphatic series polyester, 0 - 50 % of the weight of 3 inorganic fillers, 0 - 10 % of the weight of 4 hydrolysis inhibitors, and 0 - 50 % of the weight of five plasticizers.

[0020] A glass transition point Tg can give shock resistance to autoparts and household-electric-appliances components by mixing 0 degree C or less of the aliphatic series polyester which is -20 degrees C or less more preferably and/or aromatic series aliphatic series polyester. When a glass transition point Tg exceeds 0 degree C, the shock-proof amelioration effectiveness is scarce. Moreover, when an addition exceeds the above-mentioned range, decline in a rate of recycling may be caused. Aliphatic series polyester, synthetic system aliphatic series polyester, etc. which carried out ring opening polymerization of the annular lactone to the aliphatic series polyester obtained by condensing the aliphatic series polyester resin except lactic-acid system resin, for example, aliphatic series diol and aliphatic series dicarboxylic acid, and aromatic series dicarboxylic acid as aliphatic series polyester and/or aromatic series aliphatic series polyester and/or aliphatic series aromatic polyester, and a list are mentioned. Out of the terephthalic acid which are aromatic series dicarboxylic acid, such as ethylene glycol [which is aliphatic series diol], 1,4-butanediol, 1, and 4-cyclohexane dimethanol, etc. a succinic acid which is aliphatic series dicarboxylic acid, an adipic acid, a suberic acid, a sebacic acid, and dodecane diacid, isophthalic acid, naphthalene dicarboxylic acid, etc., one or more kinds of aliphatic series polyester obtained by condensing **** diol, aliphatic series dicarboxylic acid, and/or aromatic series dicarboxylic acid is chosen, carries out a condensation polymerization, and is obtained, respectively. It can jump up with isocyanate, an epoxy compound, etc. if needed, and a desired polymer can be obtained. Specifically, Bionolle by Showa High Polymer Co., Ltd., Enpole made from IREKEMIKARU, the you peck by Mitsubishi Gas Chemical Co., Inc., Easterbio by Eastman Chemical, Ecoflex by BASF A.G., etc. are mentioned.

[0021] As aliphatic series polyester which carried out ring opening polymerization of the annular lactone, it is mentioned typically, and epsilon-caprolactone which is an annular monomer, delta-valerolactone, one or more kinds of beta-methyl-delta-valerolactones, etc. are chosen, and a polymerization is carried out after this.

[0022] As synthetic system aliphatic series polyester, a copolymer with a cyclic anhydride, oxiranes, for example, a succinic anhydride and ethyleneoxide, propylene oxide, etc. is mentioned.

[0023] An inorganic filler is added for the purpose of the improvement in rigidity, abrasion resistance, thermal resistance (there being the nucleating additive effectiveness), endurance, etc. Specifically, a silica, talc, a kaolin, clay, an alumina, a non-bloating tendency mica, a calcium carbonate, a calcium sulfate, a magnesium carbonate, diatomaceous earth, asbestos, a glass fiber, a metal powder, etc. are illustrated. If an addition exceeds this range, it is in the inclination for impact strength, fabrication nature, hydrolysis-proof nature, etc. to fall, and is not desirable.

[0024] Moreover, a sheet silicate is also utilizable as an inorganic filler. A sheet silicate forms lactic-acid system resin and a nano composite, and raises the thermal resistance and rigidity of components by leaps and bounds. Moreover, penetration of the water inside resin is made difficult and hydrolysis-proof nature and gas barrier property also raise it because a monotonous particle aligns. However, since a sheet silicate reduces a melting moldability remarkably by the rise of viscosity when nano distribution is

carried out into resin, as an addition, 5 % of the weight is a limit preferably 10% of the weight.

[0025] A sheet silicate has the structure of the 2:1 molds of 8 face-piece sheet containing the element chosen from aluminum, magnesium, a lithium, etc. which a silicic acid tetrahedron sheet laps and form the plate crystal layer of one sheet up and down, and has the cation of convertibility between the layers of the plate crystal layer. The magnitude of the plate crystal of one sheet is usually 6-15Å in width of face of 0.05-0.5 micrometers, and thickness. Moreover, the thing of 0.2 - 3 meq/g is mentioned and the cation exchange capacity of the cation exchange capacity of the convertibility cation is the thing of 0.8 - 1.5 meq/g preferably. As an example of a sheet silicate, bloating tendency micas, such as various clay minerals, such as smectite system clay minerals, such as a montmorillonite, beidellite, nontronite, saponite, hectorite, and a sauconite, a vermiculite, halloysite, a money dynamite, Kenya Ito, zirconium phosphate, and phosphoric acid titanium, Li mold fluorine TENIO light, Na mold fluorine TENIO light, a Na mold 4 silicon fluorine mica, and a Li mold 4 silicon fluorine mica, etc. are mentioned, and even if it is a natural thing, it may be compounded. Bloating tendency synthetic mica, such as smectite system clay minerals, such as a montmorillonite and hectorite, and a Na mold 4 silicon fluorine mica, Li mold fluorine TENIO light, is desirable also in these.

[0026] As for a sheet silicate, it is desirable that the convertibility cation which exists between layers is the sheet silicate exchanged by organic onium ion. In a non-exchanged thing, induction of the hydrolysis of lactic-acid system resin may be carried out. As organic onium ion, ammonium ion, phosphonium ion, the sulfonium ion, etc. are mentioned. In these, ammonium ion and phosphonium ion are desirable, and especially ammonium ion is fond and is used. As ammonium ion, any of the 1st class ammonium, the 2nd class ammonium, the 3rd class ammonium, and the 4th class ammonium are sufficient. As the 1st class ammonium ion, DESHIRU ammonium, dodecyl ammonium, octadecyl ammonium, oleyl ammonium, benzylammonium, etc. are mentioned. As the 2nd class ammonium ion, methyl dodecyl ammonium, methyl octadecyl ammonium, etc. are mentioned. Dimethyl dodecyl ammonium, dimethyloctadecyl ammonium, etc. are mentioned as the 3rd class ammonium ion. As the 4th class ammonium ion, benzyl trimethylammonium, Benzyl triethyl ammonium, benzyl tributyl ammonium, Benzyl trialkyl ammonium ion, such as benzyl dimethyl dodecyl ammonium and benzyl dimethyloctadecyl ammonium, Trioctyl methylammonium, trimethyl octyl ammonium, Alkyl trimethyl ammonium ion, such as trimethyl dodecyl ammonium and trimethyl octadecyl ammonium, Dimethyl dialkyl ammonium ion, such as dimethyl dioctyl ammonium, dimethyl didodecyl ammonium, and dimethyl dioctadecyl ammonium, etc. is mentioned. Moreover, the ammonium ion guided besides these from an aniline, p-phenylene diamine, alpha-naphthylamine, p-amino dimethylaniline, a benzidine, a pyridine, a piperidine, 6-aminocaproic acid, 11-amino undecanoic acid, 12-amino dodecanoic acid, etc. is mentioned. Also in such ammonium ion, trioctyl methylammonium, trimethyl octadecyl ammonium, benzyl dimethyl dodecyl ammonium, benzyl dimethyloctadecyl ammonium, octadecyl ammonium, the ammonium guided from 12-amino dodecanoic acid are fond, and is used.

[0027] A hydrolysis inhibitor is added in order to give the endurance as autoparts and household-electric-appliances components. As a class of hydrolysis inhibitor, a hydrophobic wax, a hydrophobic plasticizer, olefin system resin, a carbodiimide compound, etc. are mentioned.

[0028] As a hydrophobic wax, 1 liquid paraffin, native paraffin, synthetic paraffin, Hydrocarbon system waxes, such as a micro crystallin wax, polyethylene wax, and a fluorocarbon wax, 2) Fatty-acid system waxes, such as a higher fatty acid and hydroxy fatty acid, 3 aliphatic-series amide, Aliphatic series amide system waxes, such as an alkylene screw fatty-acid amide, 4 fatty-acid lower alcohol ester, Alcoholic system waxes, such as ester system waxes, such as fatty-acid polyhydric-alcohol ester wax and fatty-acid polyglycol ester, 5 fatty alcohol, polyhydric alcohol, and poly glycerol, 6 metallic soap, 7, and such mixed stock are mentioned.

[0029] A liquid paraffin and a micro crystallin wax as a hydrocarbon system wax 1) As a 2 fatty-acid system wax Stearic acid and a lauric acid as a 3 aliphatic-series amide system wax Octadecanamide, a palmitic-acid amide, oleic amide, an erucic-acid amide, A methylenebis SUTEARIRO amide and an ethylene screw SUTEARIRO amide as a 4 ester system wax Butyl stearate, hardening castor oil, and ethylene glycol monostearate as a 5 alcoholic system wax Cetyl alcohol and stearyl alcohol are used as 6

metallic soap suitably [stearic acid aluminum and calcium stearate] in respect of effectiveness and cost.

[0030] As the above-mentioned hydrophobic plasticizer, it comes to choose at least one kind out of the compound shown in following the (1) - (8).

- (1) $\text{H5C3(OH)3-n(OOCCH3)}_n$ $0 < n \leq 3$ -- this is Monod of a glycerol, G, or triacetate, and although such mixture is sufficient, the direction of n near 3 is desirable.
- (2) A glycerol alkylate (an alkyl group may have the residue of carbon numbers 2-20 and a hydroxyl group), or a diglycerol alkylate. For example, glycerol tripropionate, a glycerol TORIBUCHI rate, a diglycerol tetra-acetate (3) ethylene-glycol alkylate (an alkyl group may have the residue of carbon numbers 1-20 and a hydroxyl group). For example, an ethylene glycol diacetate (4) ethylene repeat unit is five or less polyethylene-glycol alkylate (an alkyl group may have the residue of carbon numbers 1-20 and a hydroxyl group). For example, diethylene-glycol mono-acetate and diethylene-glycol diacetate (5) aliphatic-series monocarboxylic acid alkyl ester (an alkyl group is carbon numbers 1-20). For example, butyl stearate (6) aliphatic-series dicarboxylic acid alkyl ester (an alkyl group may have the residue of carbon numbers 1-20 and a carboxyl group). For example, a di(2-ethylhexyl) horse mackerel peat, di(2-ethylhexyl) azelate.
- (7) Aromatic series dicarboxylic acid alkyl ester (an alkyl group may have the residue of carbon numbers 1-20 and a carboxyl group). For example, dibutyl phthalate, dioctyl phthalate.
- (8) Aliphatic series tricarboxylic acid alkyl ester (an alkyl group may have the residue of carbon numbers 1-20 and a carboxyl group). For example, citric-acid trimethyl ester.
- (9) With a weight average molecular weight of 20,000 or less low-molecular-weight aliphatic series polyester. For example, a succinic acid, and ethylene glycol / propylene glycol condensation product (sold by Dainippon Ink, Inc. by the trade name of the poly sizer.)
- (10) Natural oil fat and those derivatives. For example, soybean oil, epoxidized soybean oil, castor oil, tung oil, rapeseed oil.

[0031] As olefin system resin, those derivatives and a copolymer can be widely used centering on polyethylene and polypropylene. For example, LDPE (low density polyethylene), LLPPE (straight chain-like low density polyethylene), VLDPE (super-low density polyethylene), EVA (ethylene-vinyl acetate copolymer), EVOH (ethylene-vinylalcohol copolymer), metallocene system resin, PP (polypropylene), IO (ionomer) and EAA (ethylene acrylic-acid copolymer), EMMA (ethylene methyl methacrylate copolymer), EMA (ethylene methyl acrylate copolymer) and EEA (ethylene ethyl acrylate copolymer), adhesive polyolefin resin, etc. are raised. When dispersibility with lactic-acid system resin is taken into consideration, resin with a small amount of polar functional groups, such as EVA and IO, is more desirable than a homopolymer.

[0032] As a carbodiimide compound, the compound which has at least one carbodiimide radical is mentioned to intramolecular. Aliphatic series, an alicycle group, or the aromatic series of these carbodiimide compounds is good. For example, Pori (4 and 4'-diphenylmethane carbodiimide), Pori (p-phenylene carbodiimide), Pori (m-phenylene carbodiimide), Pori (tolyl carbodiimide), Pori (diisopropyl phenylene carbodiimide), Pori (methyl-diisopropyl phenylene carbodiimide), Pori (triisopropyl phenylene carbodiimide), etc. are mentioned. a carbodiimide compound is independent -- or two or more sorts are combined and it is used.

[0033] If the addition of a hydrolysis inhibitor exceeds the above-mentioned range, the fault of the workability and the physical properties of a components Plastic solid falling will arise. As for superfluous addition of olefin system resin, a shock-proof fall and a poor appearance are caused and, on the other hand, superfluous addition of a hydrophobic wax, a hydrophobic plasticizer, and a carbodiimide compound causes the fabrication nature fall accompanying the fall of viscosity, the fall of mechanical strength, the bleeding on the front face of a Plastic solid, and stickiness.

[0034] Moreover, when obtaining elasticity components and elastic body components, in addition to the technique of copolymerization of an elasticity component, addition of the plasticizer to a lactic-acid system resin constituent is effective. As a plasticizer, although not limited, it can be suitably used out of instantiation of the above-mentioned hydrophobic plasticizer. If an addition exceeds the above-

mentioned range, a plasticizer will carry out bleeding with time, or machine physical properties will fall remarkably.

[0035] Stereo complex can also be made to form in order to obtain the higher thermal resistance as autoparts or household-electric-appliances components. This can be substantially attained by mixing the Pori D lactic acid with the Pori L lactic acid substantially. substantial -- DL configuration of lactic-acid system resin -- L body:D object =100:0-90:10 -- it points out preferably 100:0-94:6 or L body:D object =0:100-10:90, and that it is L body:D object =0:100-6:94. Usually, although the melting point of the above-mentioned lactic-acid system resin is 140-170 degrees C, it is considering as stereo complex, and goes up at 200-230 degrees C, and thermal resistance high as components is easy to give.

[0036] In autoparts and household-electric-appliances components, addition of an antistatic agent is desirable. It is desirable to be chosen out of the compound of following (1) - (3) by the viewpoint of the hydrolysis prevention under melting shaping as an antistatic agent. As an addition, it is 0.3 - 4.0 % of the weight preferably 0.1 to 10% of the weight.

(1) Polyethylene-glycol addition products, such as polyhydric alcohol, such as ethylene glycol, a diethylene glycol, triethylene glycol, a glycerol, trimethylol propane, a pen TAERU slit, and sorbitol, the fatty-acid-ester (2) polyethylene glycol and/or the fatty-acid-ester (3) higher alcohol, polyhydric alcohol, and alkylphenol, or a polypropylene-glycol addition product [0037] Moreover, additives, such as a thermostabilizer, an anti-oxidant, UV absorbent, light stabilizer, a pigment, a coloring agent, lubricant, and a nucleating additive, can be prescribed in the range which does not spoil the effectiveness of this invention.

[0038] The autoparts and the household-electric-appliances components of this invention are fabricated and used as a rigid object, an elastic body, a fiber structure object, or foam by the device on the polymer structure of raw material resin, a combination presentation, and fabrication.

[0039] As a rigid object of autoparts, a front bumper, FESHA, A fender, a side garnish, a pillar garnish, a rear spoiler, A bonnet, a radiator grille, a door handle, a head lamp lens, An instrument panel, a trim, an air-cleaner case, an air intake duct, a surge tank, A fuel tank, an intake manifold, distributor components, Fuel-injection components, an electrical connector, an engine rocker box cover, engine ornament covering, a timing belt cover, a belt-tensioner pulley, a chain guide, a cam sprocket, a generator bobbin, etc. are mentioned. As an elastic body, an engine rubber vibration insulator, various tubes, various packing, a tire, a timing belt, etc. are mentioned, as a fiber structure object, a sheet, a pyro, a mat, an inner plate, a door panel, a door board, head-lining material, an air bag, a seat belt, interior material, etc. are mentioned, and a seat cushion, a heat insulation sheet, interior material, etc. are mentioned as foam.

[0040] As a rigid object of household-electric-appliances components, a case, a cabinet, a roller, a fan, a bearing, a printed circuit board, a connector, a bulb, a case, a shielding plate, a carbon button, a switch handle, etc. are mentioned, a rubber vibration insulator, a tube, packing, a door sash, a timing belt, etc. are mentioned as an elastic body, as a fiber structure object, a filter, covering, etc. are mentioned and a heat insulator, a space filler, etc. are mentioned as foam.

[0041] Next, the fabricating method is explained. In this invention, although a known approach and equipment can be used for the fabricating method and shaping equipment of components, it doubles with a part shape and injection molding, extrusion molding, press forming, blow molding, and the SMC method are used suitably. Moreover, it is processed into the gestalt of textiles, knitting, a nonwoven fabric, FRP, SMC, etc., etc. as a fiber structure object.

[0042] Although the dryblend of each component of a constituent may be carried out and a making machine may be directly presented when performing melting shaping of injection molding, extrusion molding, blow molding, etc., it is desirable to perform compound-ization in advance and to pelletize a constituent using a biaxial extruder etc. It is more advantageous from the functional manifestation of each component, and a viewpoint of total workability to perform a compound in advance.

[0043] The important thing in this invention is controlling the relative degree of crystallinity of the lactic-acid system resinous principle which adjusts a resin presentation, resin temperature, a die temperature, cooling conditions, etc. (especially die temperature), or performs reheating heat treatment,

and is contained in a lactic-acid system resin constituent in 30 - 100% of range. If less than this range, the thermal resistance of shaping components and wet heat endurance will be hard to be acquired. Especially, from a heat-resistant field, components deform in the ambient atmosphere exceeding 60 degrees C, use is restricted as autoparts or household-electric-appliances components, and an application is limited. By promoting crystallization, even if put to a 60-130-degree C ambient atmosphere, it will not deform. By DL ratio of lactic-acid system resin, the class of constituent, addition of a nucleating additive, etc., although relative degree of crystallinity changes, it increases, so that a cooling rate is generally slow.

[0044] In the case of the fabricating method using metal mold, in order to balance relative crystallinity and a moldability, it is desirable that 60-130 degrees C of die temperatures are 80-120 degrees C preferably. A crystallization rate is slow, below with this temperature, obtaining desired relative degree of crystallinity takes time amount too much, above this temperature, although a crystallization rate is quick, adhesion tends to take place to the metal mold of a Plastic solid, a molding cycle may not go up, a Plastic solid may deform at the time of the ejection from metal mold, or a crystallization rate may fall conversely at an elevated temperature further. The contact time to metal mold is preferably adjusted in the range for 10 - 100 seconds for 1 to 1000 seconds.

[0045] Moreover, it is desirable to come to compound these autoparts and household-electric-appliances components with a natural fiber depending on an application. A natural fiber points out hemp, a jute, a kenaf, a bagasse, a jute, corn fiber, bamboo fiber, wool, etc., and the rayon of the natural product origin, a viscose, acetate, etc. are included in a wide sense. The rigidity of components and shock resistance improve by compounding with a natural fiber. Moreover, in an automobile or household electrical products industry, it is in the inclination for a glass fiber to be evaded, from a viewpoint of specific gravity or recycle nature, and use of a natural fiber does not have such un-arranging in recent years. Moreover, since lactic-acid system resin is manufactured considering starch as a raw material, it serves as the all vegetable origin and can attain coalescence-ization of a concept. As a mixed rate, although based also on an application, lactic-acid system resin constituent:natural fiber =99:1-60:40 (% of the weight) is desirable. If less than this range, neither rigidity nor the shock-proof amelioration effectiveness is acquired, but if it exceeds, fabrication nature and machine physical properties will fall. In addition to the approach of obtaining the continuous glass fiber strengthening pellet (LFP) to the resin constituent of a staple fiber scouring and according to fiber drawing shaping, as a compound approach, a method of sinking in the lactic-acid system resin constituent to textile fabrics and a nonwoven fabric, press forming of the interweaving nonwoven fabric of a lactic-acid system resin constituent and a natural material, etc. by press forming are mentioned.

[0046] About foaming, what kind of well-known approach is also employable. namely, -- as the gestalt of shaping -- mold foaming and extrusion foaming -- any are sufficient and chemistry foaming, gas foaming, extension void foaming, etc. are mentioned as a means of foaming. As a chemistry foaming agent, an AZOJI carvone amide (ADCA), a sodium hydrogencarbonate, etc. are suitable, and a carbon dioxide tends to obtain a uniform cel from the relation of the melting point of lactic-acid system resin as gas of gas foaming. In order to obtain the suitable high melting tension for foaming, in extrusion foaming Dicumyl peroxide, 1 and 1-G t-butylperoxycyclohexane, t-butylperoxy-3,5,5-trimethyl hexanoate, 2,2-Di-t-butyl-peroxy-butane, t-butylperoxyisopropylcarbonate, Tert-butyl peroxide-2-ethylhexyl carbonate, t-amyl peroxy benzoate, T-butyl peroxyacetate, 4, and 4-G tert-butyl peroxide valeric-acid-n-butylester, T-butyl peroxybenzoate, 2, the 5-dimethyl -2, 5-G (tert-butyl peroxide) hexane, 1, 3-screw-(t-butyl PAOKI seesaw propyl) benzene, t-butyl cumyl peroxide, It is good to add the organic peroxide of di-t-butyl peroxide, 2, the 5-dimethyl -2, and 5-G (tert-butyl peroxide) hexyne-3 grade 0.05 to 2.0% of the weight.

[0047] After using the autoparts which consist of a lactic-acid system resin constituent by which fabrication was carried out as mentioned above, and household-electric-appliances components, they can perform trash recycle easily through shredder dust. Namely, what is necessary is to enclose into a container the shredder dust which a metal and glass may be mixing as a fundamental procedure, to heat, purging inert gas, such as dehumidification air and nitrogen, to disassemble lactic-acid system resin and

just to collect the steams which volatilized. As whenever [stoving temperature], the range of 170-250 degrees C is desirable preferably 150-280 degrees C. If there will be few steamy generating degrees and cost will start industrially, if less than this temperature, and it exceeds conversely, the rate of the side reaction by heat will become large, and it will be hard to collect effective steams. Moreover, 100 or less torrs of steams will tend to collect them, if a heating container and a recovery path are preferably made reduced pressure of 20torr(s). A steamy principal component is a lactide which is the monomer of polylactic acid, and contains a small amount of lactic acid and a lactic-acid dimer. Since the melting point of L lactide and D lactide is 95 degrees C, the recovery effectiveness of a solid-state lactide increases by cooling preferably 95 degrees C or less of 60 degrees C or less of recovery systems at 30 degrees C or less still more preferably.

[0048] At the time of heating, although the catabolic rate of lactic-acid system resin will be rash in zirconium system compounds, such as titanium system compounds, such as tin compounds, such as lactic-acid tin, tartaric-acid tin, JIKAPURIRU acid tin, dilauryl acid tin, dipalmitate tin, distearic acid tin, JIOREIN acid tin, alpha-NAFUETO acid tin, beta-naphthoic-acid tin, and octylic acid tin, and tetra-propyl titanate, and zirconium isopropoxide, etc. to shredder dust if it adds 0.1 to 3% of the weight, it is not necessarily required. In shredder dust, catalyst components, such as a metal, are contained to some extent, and it is thought that the same acceleration effectiveness is discovered.

[0049] Moreover, if the constituent which consists of a lactic-acid system resin constituent in shredder dust contains 0.1 - 1.0% of moisture, the acceleration effectiveness of catabolic rate can be acquired. At 0.1% or less, if there is no difference in the time of moisture not existing, and catabolic rate and it exceeds 1.0%, although decomposition is early, the yield of the lactide which is an active principle falls and it is not desirable. The principal chain of lactic-acid system resin is cut by existence of moisture, and it thinks for the molecule end which is the active spot of lactide generation to increase.

[0050] In this way, the polymerization of the collected lactide can be again carried out by well-known approach which is indicated by the U.S. Pat. No. 4,057,537 number specification, and it can be easily used as lactic-acid system resin.

[0051]

[Example] Although an example is shown below, this invention does not receive a limit at all by these. In addition, on conditions as shown below, the measured value shown in an example measured and was computed.

(1) a relative degree-of-crystallinity Plastic solid -- the about 10mg shape of a scale of 5mmphi -- deleting -- sending -- the PerkinElmer make -- using DSC-7, temperature up measurement was performed based on JIS-K7121, and it computed by the following formula.

relative degree-of-crystallinity (% of the weight) = $\{ (H_m - H_c) / H_m \} \times 100$ -- here -- the amount of heat of fusions H_c :amount (2) shock resistance of heat of crystallization of a lactic-acid system resinous principle of a H_m :lactic-acid system resinous principle (Izod impact test)

The sample was directly fabricated in width-of-face [of 10mm] x die-length [of 80mm] x thickness of 4mm, or it started from the Plastic solid, and the Izod impact test was performed by the notch and edge WAIZU (notch type A) using the omnipotent Yasuda energy machine factory impact tester (part number 258) based on JISO180. In addition, a unit is KJ/m².

(4) The heat-resistant Plastic solid was put into 100-degree C hot blast oven for 30 minutes. It judged visually, and O was shown for what deformation was not accepted in, and * and the thing which deformed clearly were shown for what deformation was slightly accepted in as x. Moreover, the 130-degree C trial was performed in a part of examination.

(5) Gel-permeation-chromatography HLC-8120GPC by weight-average-molecular-weight TOSOH CORP. of lactic-acid system resin was equipped with GPC-800CP of the chromatographic column Shim-Pack series by Shimadzu Corp., it measured wt/vol% of the weight at a part for solvent chloroform and solution concentration 0.2 solution injection rate 200microl and 1.0ml [of the solvent rates of flow], and the solvent temperature of 40 degrees C, and the weight average molecular weight of lactic-acid system resin was computed by polystyrene conversion. The weight average molecular weight of the used standard polystyrene is 2 million, 670000, 110000, 35000, 10000, 4000, and 600.

(6) Wet heat endurance (molecular weight retention)

the Tabai Espec constant temperature which adjusted the Plastic solid to 85 degree-Cx85% of the weight -- it put into constant humidity machine LH-112 for 30 hours. The molecular weight retention (% of the weight) of the lactic-acid system resin before and behind a trial was computed, and the following judgments were performed.

O For molecular weight retention, 75 - 100 % of the weight ** molecular weight retention is 50-. 74 % of the weight x Molecular weight retention is 0-. Out of 49-% of the weight moisture-regain [(7)] shredder dust, the constituent which consists of a lactic-acid system resin constituent visually was sorted out, and it asked with the Karl Fischer technique.

(8) It opened, the bending elastic modulus of a board and the test piece of 50x150mm of bending maximum loads were supported for spacing of 100mm by two points, and the load was added the rate for 50mm/from the top face of a test piece in the point of the center between the supporting points. From the variation rate at this time, and the relation of a load, a bending elastic modulus and bending maximum load were computed.

(9) recycle nature -- the weight of the lactic-acid system resin which components shaping took the weight of the lactic-acid system resin finally recycled first -- **** -- by things, the rate of recycling was computed by the percentage (%), and it judged in accordance with the following criteria.

O For a rate of recycling, a 50 - 100 % of the weight ** rate of recycling is 20 - 49 % of the weight x. The rate of recycling performed comprehensive evaluation in accordance with the criteria of (10) synthesis evaluation following zero to 19% of the weight.

O It is usable x by fitness ** application limitation etc. Defect [0052] (Example 1) L body: -- lactic-acid system resin [by Cargill Dow]: which is D object =99:1 -- with NatureWorks4031D (weight average molecular weight 200,000) Aliphatic series polyester resin by Showa High Polymer Co., Ltd. whose glass transition temperature Tg is -45 degree C (polybutylene succinate horse mackerel peat) : Bionolle 3003, As an inorganic filler, as the talc:micro ace L and the hydrolysis inhibitor by the Japanese talc company Bayer carbodiimide : The dryblend of SUTABAKUZORU P is carried out by lactic-acid system resin / aliphatic series polyester / inorganic filler / hydrolysis inhibitor =65/28/15/2 (% of the weight). Using the small said direction biaxial extruder by Mitsubishi Heavy Industries, LTD., the compound was carried out at 200 degrees C, and the raw material pellet was obtained. Injection molding of the case (two piece, weight of 22g) of a 35x118x17mm cellular phone was carried out for the raw material which carried out the compound using the injection molding machine TS 170 by Toshiba Corp. with the resin temperature of 200 degrees C, and the die temperature of 40 degrees C. Next, this case was fixed to the frame, at 80 degrees C, it heated for 10 minutes and crystallization processing was performed. it checked that the aperture of 1.2 -g acrylic resin be attach, it painted in 2 liquid type urethane coatings on a case front face at metallic blue, other components, such as a mounting unit, a shielding plate, the poly dome, and an antenna receipt case, assembled a cellular phone to this case using the existing ingredient, respectively, and it could be used for it convenient as a telephone function with a 0.5 -g metal frame. The evaluation result of relative degree of crystallinity, thermal resistance, and wet heat endurance was summarized in Table 1. Moreover, small injection ***** PS40E5A by NISSEI PLASTIC INDUSTRIAL CO., LTD. which equipped coincidence with the metal mold of the piece configuration of an Izod test was presented, injection molding was performed in cylinder-temperature [of 200 degrees C], die-temperature [of 80 degrees C], and molding cycle 40 seconds, and the Plastic solid was acquired. A shock-proof test result is shown in Table 1.

[0053] Next, after using these 100 cellular phones, it dissolved, and the mounting unit, the shielding plate, the poly dome, the antenna receipt case, etc. were removed, the case part (an aperture and with a window frame) which remained was ground using the plastics grinder plan key PC 22 by the Watanabe steelworks company, and it considered as the shredder dust which a metal and acrylic resin mixed. While putting in into the stainless steel container of 10L which connected this shredder dust (0.3% of moisture regain) with the cooling system, heating at 230 degrees C and purging a small amount of nitrogen, it decompressed from the cooling-system side by 10torr, and changed into the condition as it is for 3 hours.

[0054] Consequently, 1.8kg needle crystal deposited on the cooling wall surface, and IR measurement showed that it was L lactide. When calculated from the amount of the lactic-acid system resin used at the time of shaping, recovery was 80% or more. Into the heating container, residue, such as acrylic resin of an aperture, a metal of a window frame, an urethane coating, and an inorganic filler, non-decomposed lactic-acid system resin, remained.

[0055] It put into 5L batch type polymerization tank which carried out octylic acid tin 15ppm addition, and equipped collected L lactide with an agitator and heating apparatus. The nitrogen purge was performed and the polymerization was performed by 185 degrees C and agitating speed 100rpm for 120 minutes. Having presented the 30mmphi said direction biaxial extruder equipped with three steps of vacuum vents by Mitsubishi Heavy Industries, LTD. with the obtained melt, and devolatilizing it by vent ** 4torr, at 200 degrees C, it extruded in the shape of a strand, and pelletized. The 200,000 or L body content of the weight average molecular weight of the obtained lactic-acid system resin was 99.5%. Being able to obtain the 1.6kg lactic-acid system, the rate of recycling of lactic-acid system resin was 72%.

[0056] (Example 2) The Plastic solid was acquired like the example 1 except having used the Easter biotechnology by Eastman Chemical which is aliphatic series aromatic polyester resin instead of aliphatic series polyester resin. Moreover, the same approach as an example 1 estimated. A result is shown in Table 1.

[0057] (Example 3) A hydrolysis inhibitor was not added but the Plastic solid was acquired like the example 1 except having changed with lactic-acid system resin / aliphatic series polyester / inorganic filler / hydrolysis inhibitor =65/30/15/0 (% of the weight). Moreover, the same approach as an example 1 estimated. A result is shown in Table 1.

[0058] (Example 4) The Plastic solid was acquired like the example 1 except having changed some inorganic fillers (3 % of the weight in 15 % of the weight) into the organic-ized bentonite made from hoe JUN. Moreover, the same approach as an example 1 estimated. A result is shown in Table 1. However, an organic-ized bentonite is the inorganic filler for nano composites with which surface preparation of the front face was carried out by trimethyl stearyl benzylammonium. Moreover, deformation was not seen although the trial which is 130 degrees C which deformation generates was also performed with the mold goods of an example 1 as a heat resistance test at this time.

[0059] (Example 5) The Plastic solid was acquired like the example 1 except changing with lactic-acid system resin / aliphatic series polyester / inorganic filler / hydrolysis inhibitor =83/0/15/2 (% of the weight). Moreover, the same approach as an example 1 estimated. A result is shown in Table 1. Although the acquired Plastic solid does not have deficiently desirable shock resistance, it can be used if an application and a usage are limited.

[0060] (Example 6) The same approach as an example 1 estimated except not performing crystallization processing after injection molding. A result is shown in Table 1. Although thermal resistance is not deficiently desirable, it can be used if an application and a usage are limited.

[0061] (Example 7) The same approach as an example 1 estimated except changing the one half of lactic-acid system resin into the Pori D-lactic-acid:PYURASOBU polymer PD by the PYU rack company. A result is shown in Table 1. At this time, it checked by DSC that stereo complex formed the part by blending with Pori L-lactic acid and a Pori D-lactic acid. Furthermore, deformation was not seen although the trial which is 130 degrees C which deformation generates was also performed with the mold goods of an example 1 as a heat resistance test.

[0062] (Example 8) Ten weight sections addition of the bamboo fiber (diameter [of 70 micrometers] fiber length of 500 micrometers) by the Hirose industrial company was carried out to the resin constituent of an example 1, and the Plastic solid was acquired like the example 1 except using the compound pellet of the presentation of lactic-acid system resin / aliphatic series polyester / inorganic filler / hydrolysis inhibitor / bamboo fiber =65/28/15/2/10. Moreover, the same approach as an example 1 estimated. A result is shown in Table 1. Moreover, deformation was not seen although the trial which is 130 degrees C which deformation generates was also performed with the mold goods of an example 1 as a heat resistance test.

[0063]

[Table 1]

	実施例 1	実施例 2	実施例 3	実施例 4	実施例 5	実施例 6	実施例 7	実施例 8
相對結晶 化度(重 量%)	90	83	90	90	81	15	89	90
耐熱性	○	○	○	◎	○	×	◎	◎
濕熱 耐久性	○	○	△	○	○	○	○	○
耐衝擊性 (kJ/m ²)	30	32	32	30	2	31	29	34
リサイク ル性	○	○	○	○	○	○	○	○
総合評価	○	○	△	◎	△	△	◎	◎

[0064] (Example 9) The Plastic solid was acquired like the example 1 except adjusting the moisture regain of the lactic-acid resin constituent contained in the shredder dust put into the stainless steel container for heating recovery to 8%. Moreover, the same approach as an example estimated recycle nature. A result is shown in Table 2.

[0065] (Example 10) The Plastic solid was acquired like the example 1 except heating the stainless steel container for heating recovery at 300 degrees C. Moreover, the same approach as an example estimated recycle nature. A result is shown in Table 2.

[0066]

[Table 2]

	実施例 9	実施例 10
リサイク ル性	△	△

[0067] (Example 11) It mixed with cotton to homogeneity so that jute fiber (the diameter of average fiber of 20 deniers, fiber length of 30-50mm) and lactic-acid system resin fiber (the lactron by the Kanebo synthetic fiber company, 100% of Pori L lactic acids of weight average molecular weight 150,000, the diameter of fiber of 5 deniers, fiber length of 50mm) might be set to jute fiber:lactic-acid system resin fiber = 70/30 by the weight ratio, and eyes produced the web of 150 g/m². The needle punch nonwoven fabric with a thickness of 3mm was produced by giving needle punch by the consistency of 200/m² to this web. The sheet with a thickness of 0.3mm was obtained by compressing this nonwoven fabric with the hot calender roll of the roll temperature of 180 degrees C, and the path clearance between rolls. These ten sheets cut down on 1m square were accumulated, with 100t heat press machine, carried out the heat press for 15 minutes, it was made to cool slowly and crystalize over 15 minutes at 180 degrees C, and the board was obtained. The bending elastic modulus of the done board is 3.6GPa, bending maximum loads are 28N / 50mm, and the engine performance more than the board produced using conventional PP fiber and kenaf fiber was obtained.

[0068] Using a board as a backdoor board, the backdoor of private-vehicle Dingo by MITSUBISHI MOTORS CORP. was equipped, and although it operated a total of 2000km in two months, the problem was not generated. The bulky garbage grinder by Mitsubishi Heavy Industries, LTD. ground this door part, iron etc. was classified using the magnetic type separator, the air separation machine, and the screen, and shredder dust was obtained. This shredder dust was put into the stainless steel container of 50L, and the same approach as an example 1 considered recycle. However, moisture regain was 0.4%. The rate of recycling which passed through the polymerization process of lactide recovery and lactic-acid system resin was 75% to the weight of the used lactic-acid system resin fiber, and was good.

[0069]

[Effect of the Invention] As mentioned above, as explained in detail, according to this invention, products, such as autoparts excellent in physical properties and recycle nature, a household-electric-appliances component, and its shredder dust, and a list can be provided with the recycle approach of the product excellent in economical efficiency.

[Translation done.]